What is claimed is:

1. An oxynitride film forming method comprising:

a reaction chamber heating step of heating a reaction chamber to a predetermined temperature, the reaction chamber containing an object to be processed;

a gas heating step of heating a process gas to a temperature not lower than a reaction temperature at which an oxynitride film can be formed, the process gas consisting of dinitrogen oxide gas; and

a film forming step of forming an oxynitride film on the object to be processed by supplying the heated process gas into the heated processing chamber;

wherein the temperature to which the reaction chamber is heated in the reaction chamber heating step is set at a temperature below a temperature at which the process gas undergoes a reaction.

2. An oxynitride film forming method according to claim 1, wherein

the process gas is heated to a temperature at which the process gas is pyrolyzed substantially completely, in the gas heating step.

3. An oxynitride film forming method according to claim 2, wherein

the reaction chamber is heated to a temperature in a range of 750 to 850 °C in the reaction chamber heating step, and

the process gas is heated to 900 °C or above in the gas heating step.

4. An oxynitride film forming system comprising:

a reaction vessel defining a reaction chamber that can contain an object to be processed;

a reaction chamber heating unit that can heat the reaction chamber to a predetermined temperature;

a process gas supplying unit that can supply a process gas into the reaction chamber, the process gas consisting of

dinitrogen oxide gas;

a gas heating unit, provided at the gas supplying unit, that can heat the process gas to a predetermined temperature before the process gas is supplied into the reaction chamber; and

a controller that can control the gas heating unit so as to heat the process gas to a temperature not lower than a reaction temperature at which an oxynitride film can be formed and control the reaction chamber heating unit so as to heat the reaction chamber to a temperature below a reaction temperature at which the process gas undergoes a reaction.

5. An oxynitride film forming system according to claim 4, wherein

the reaction vessel defining the reaction chamber includes an inner tube that contains the object to be processed and an outer tube that surrounds the inner tube, and

the gas supplying unit is adapted to supply the process gas into the inner tube.

6. An oxynitride film forming system according to claim 4, wherein

the controller is adapted to control the gas heating unit to heat the process gas to a temperature at which the process gas is pyrolyzed substantially completely.

7. An oxynitride film forming system according to claim 6, wherein

the controller is adapted to control the gas heating unit to heat the process gas to 900 °C or above, and to control the reaction chamber heating unit to heat the reaction chamber to a temperature in a range of 750 to 850 °C.

8. A silicon dioxide film forming method comprising:

a reaction chamber heating step of heating a reaction chamber to a predetermined temperature, the reaction chamber containing an object to be processed having a surface provided

with at least a silicon layer;

a gas pretreating step of energizing a process gas to produce water, the process gas containing a compound gas including hydrogen and chlorine, and oxygen gas; and

a film forming step of forming a silicon dioxide film by supplying the process gas that has been energized to produce water into the heated reaction chamber to oxidize the silicon layer of the object to be processed.

9. A silicon dioxide film forming method according to claim 8, wherein

the water is produced in the gas pretreating step to an extent such that the process gas does not produce water any further at the temperature to which the reaction chamber is heated.

10. A silicon dioxide film forming method according to claim 8, wherein

the process gas is energized to produce water by heating the process gas, in the gas pretreating step.

11. A silicon dioxide film forming method according to claim 10, wherein

the process gas is heated to a temperature that is higher than the temperature at which the reaction chamber is heated in the reaction chamber heating step.

12. A silicon dioxide film forming method according to claim 8, wherein

the compound gas including hydrogen and chlorine is a hydrogen chloride gas.

13. A silicon dioxide film forming system comprising:

a reaction vessel defining a reaction chamber that can contain an object to be processed having a surface provided with at least a silicon layer;

a reaction chamber heating unit that can heat the reaction chamber to a predetermined temperature;

a process gas supplying unit that can supply a process gas into the reaction chamber, the process gas containing a compound gas including hydrogen and chlorine, and oxygen gas; and

a gas heating unit, provided at the gas supplying unit, that can heat the process gas to produce water before the process gas is supplied into the reaction chamber.

14. A silicon dioxide film forming system according to claim 13, wherein

the reaction chamber can contain a plurality of objects to be processed in a tier-like manner, and

the reaction chamber heating unit has a heater surrounding the reaction chamber.

15. A silicon dioxide film forming system according to claim 13, wherein

the gas heating unit comprises:

a heating vessel defining a heating chamber packed with flow impeding members, and

a heating element surrounding the heating chamber; and

the heating element includes a resistance heating member and a ceramic cover sealing the resistance heating member therein.

16. A silicon dioxide film forming system according to claim 15, wherein

the resistance heating member is made of carbon with a high purity.

17. A silicon dioxide film forming system according to claim 15, wherein

the ceramic cover is made of quartz.

18. A silicon nitride film forming method comprising:

a reaction chamber heating step of heating a reaction chamber to a predetermined temperature, the reaction chamber containing an object to be processed having a surface provided with at least a silicon layer;

a reaction chamber pressure regulating step of regulating pressure in the reaction chamber to a predetermined pressure;

a gas heating step of preheating trimethylamine to a temperature such that the preheated trimethylamine can produce nitrogen when heated in the reaction chamber; and

a film forming step of forming a silicon nitride film by supplying a process gas including the preheated trimethylamine and a silane gas into the reaction chamber to nitride the silicon layer of the object to be processed.

19. A silicon nitride film forming method according to claim 18, wherein

the reaction chamber is heated to a temperature in a range of 400 to 650 °C in the reaction chamber heating step, and

the trimethylamine is heated to a temperature in a range of 500 to 700 °C in the gas heating step.

20. A silicon nitride film forming method according to claim 18, wherein

the trimethylamine is heated under a pressure in a range of 20 to 90 kPa in the gas heating step.

21. A silicon nitride film forming system comprising:

a reaction vessel defining a reaction chamber that can contain an object to be processed having a surface provided with at least a silicon layer;

a reaction chamber heating unit that can heat the reaction chamber to a predetermined temperature;

a reaction chamber pressure regulating unit that can regulate pressure in the reaction chamber to a predetermined pressure;

a first gas supplying unit that supplies a silane gas into the reaction chamber;

a second gas supplying unit that supplies trimethylamine gas into the reaction chamber;

a gas heating unit, provided at the second gas supplying unit, that can preheat the trimethylamine gas to a predetermined

temperature; and

a controller that can control the gas heating unit so as to preheat the trimethylamine gas to a preheating temperature such that the trimethylamine gas preheated to the preheating temperature can produce nitrogen when heated in the reaction chamber.

22. A silicon nitride film forming system according to claim 21, wherein

the reaction vessel defining the reaction chamber includes an inner tube that contains the object to be processed and an outer tube that surrounds the inner tube,

the first gas supplying unit is adapted to supply the silane gas into the inner tube, and

the second gas supplying unit is adapted to supply the trimethylamine gas into the inner tube.

23. A silicon nitride film forming system according to claim 21, wherein

the second gas supplying unit has a gas supply pipe connected to the reaction chamber, and the gas supply pipe is provided with a restricting part formed by reducing an inside diameter of the gas supply pipe on a downstream side of the gas heating unit.

24. A silicon nitride film forming system according to claim 21, wherein

the controller is adapted to control the gas heating unit to heat the trimethylamine to a temperature in a range of 500 to 700 °C, and to control the reaction chamber heating unit to heat the reaction chamber to a temperature in a range of 400 to 650 °C.

25. A silicon nitride film forming system according to claim 21, wherein

the gas heating unit is adapted to heat the trimethylamine under a pressure in a range of 20 to 90 kPa.

26. A silicon dioxide film forming method comprising:

a reaction chamber heating step of heating a reaction chamber to a predetermined temperature, the reaction chamber containing an object to be processed having a surface provided with at least a silicon layer;

a reaction chamber pressure regulating step of regulating pressure in the reaction chamber to a predetermined pressure;

a gas heating step of preheating dinitrogen oxide gas to a temperature not lower than 700 °C; and

a film forming step of forming a silicon dioxide film by supplying a process gas including the preheated dinitrogen oxide gas and a silane gas into the reaction chamber to oxidize the silicon layer of the object to be processed.

27. A silicon dioxide film forming method according to claim 26, wherein

the dinitrogen oxide gas is heated to a temperature in a range of 750 to 950 °C in the gas heating step.

28. A silicon dioxide film forming system comprising:

a reaction vessel defining a reaction chamber that can contain an object to be processed having a surface provided with at least a silicon layer;

a reaction chamber heating unit that can heat the reaction chamber to a predetermined temperature;

a reaction chamber pressure regulating unit that can regulate pressure in the reaction chamber to a predetermined pressure;

a first gas supplying unit that supplies a silane gas into the reaction chamber;

a second gas supplying unit that supplies dinitrogen oxide gas into the reaction chamber;

a gas heating unit, provided at the second gas supplying unit, that can preheat the dinitrogen oxide gas to a predetermined temperature; and

a controller that can control the gas heating unit so as

to preheat the dinitrogen oxide gas to a temperature not lower than 700 °C.

29. A silicon dioxide film forming system according to claim 28, wherein

the reaction vessel defining the reaction chamber includes an inner tube that contains the object to be processed and an outer tube that surrounds the inner tube,

the first gas supplying unit is adapted to supply the silane gas into the inner tube, and

the second gas supplying unit is adapted to supply the dinitrogen oxide gas into the inner tube.

30. A silicon dioxide film forming system according to claim 29, wherein

the second gas supplying unit has a gas supply pipe connected to the reaction chamber, and the gas supply pipe is provided with a restricting part formed by reducing an inside diameter of the gas supply pipe on a downstream side of the gas heating unit.

31. A silicon dioxide film forming system according to claim 28, wherein

the controller is adapted to control the gas heating unit to heat the dinitrogen oxide gas to a temperature in a range of 750 to 950 °C.